UXO Calculator

USACE OE Stand-down 2001

Outline

- Tool Background
  - Reason for development
  - Technical details
- Tool Selection
- Tool Use

Reason for Development

- Developed to be utilized at UXO sites where some method of discrimination is used to determine what anomalies to investigate
- Developed to assist the field teams in determining their sampling needs based on sector density and not on sector homogeneity

Technical Details

- Mathematics of the tool are based on the negative binomial probability distribution
- Assumes that there is a uniform probability of UXO occurrence over the site (equal likelihood for UXO to fall anywhere in the sector)
- UXO is assumed to have been deposited randomly

Tool Selection

- Technical Project Planning (TPP) Process
  - The TPP team determines its data requirements and selects the tools/methods appropriate to meet those requirements
  - Statistical survey and analysis using UXO Calculator may be appropriate for those requirements
- Tool requirements
  - Range or range-like area
    - Can separate into impact and buffer
  - Need for data developed
- Verify that the tool selected communicates what you want to communicate.

Applications

- Before sampling
  - helps determine how much sampling will be needed to reach goals
- After sampling
  - helps determine confidence intervals in ordnance contamination predictions
  - Calculates the expected number of UXO items remaining in a homogeneous area or the probability that there is no more UXO in a given area
  - Estimates expected UXO density in a given sector

Before Sampling

- Establish a target density for each Area of Concern (AOC)
  - 0.1 UXO per acre – public usage of the land is significant
  - 0.5 UXO per acre – public usage of the land is moderate
  - 1.0 UXO per acre – public usage of the land is minor
- Determine the amount of sampling required to meet the target density assuming no UXO is found (Minimum Discriminator module)
- Example target density statistical statement: 90% confidant that the density is 0.1 UXO per acre or less assuming that no UXO is found.

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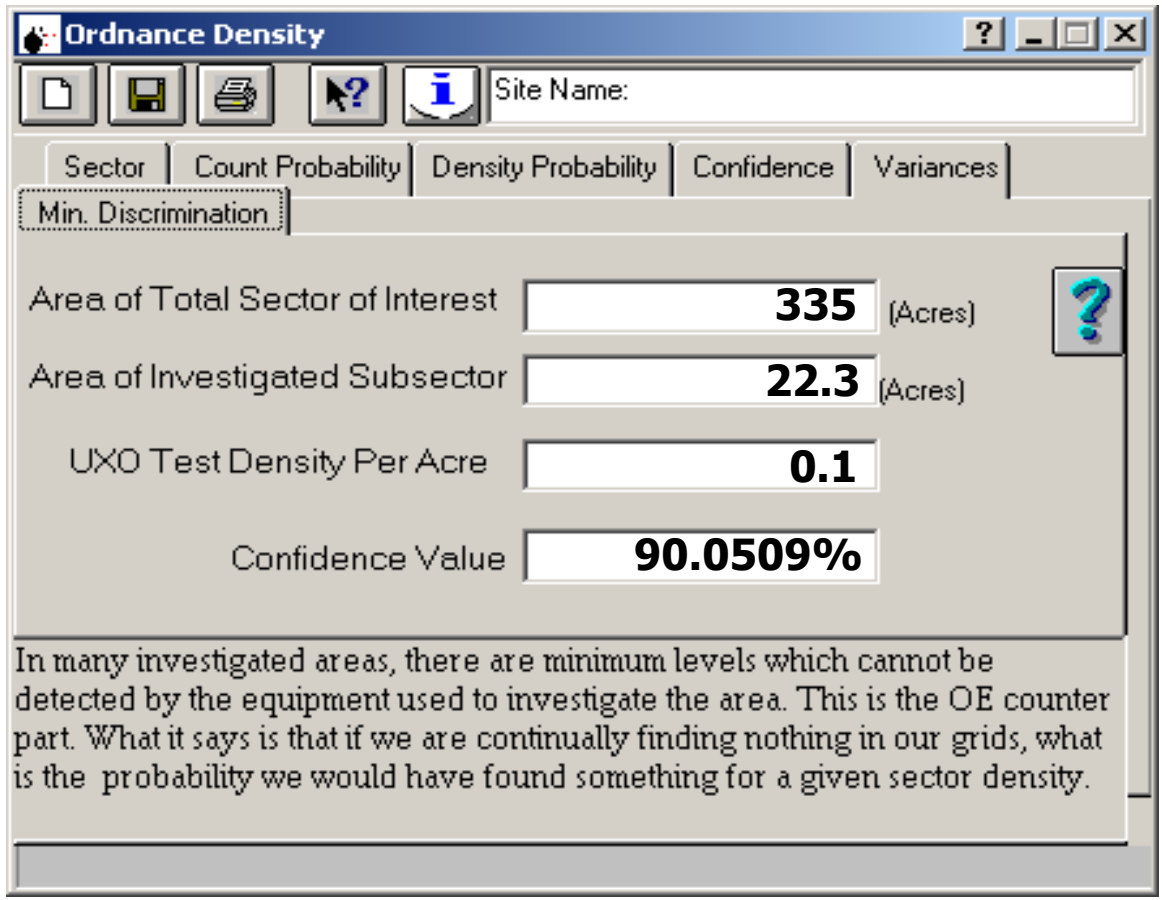
Minimum Discrimination Module



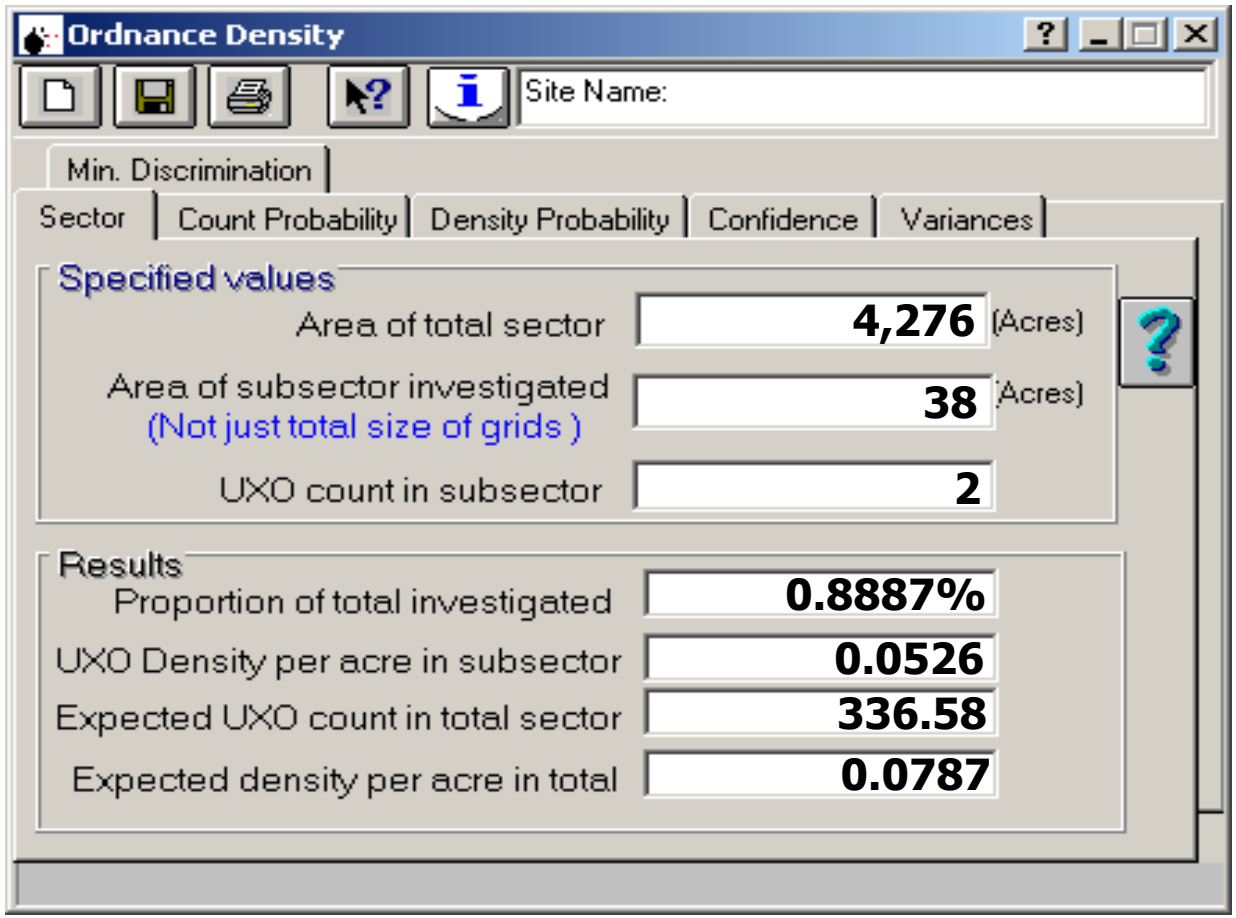
During Sampling

- The Minimum Discriminator module calculates the amount of sampling that must be performed to meet the target density assuming that **no UXO is found**.
- If UXO is found during sampling, the team can:
  - Accept that the target density will be exceeded
  - Accept a lower confidence using the same target density
  - Calculate the additional amount of sampling (using the sector and confidence modules) that must be performed to still meet the target density even though UXO items have been found

After Sampling

- Determine the UXO density/count at the site using the appropriate module
  - Sector module (required input for use of the other modules)
    - calculates the “expected” UXO density for the sector
  - Count Probability module
    - calculates the probability of “x” number of UXO in the sector
  - Density Probability module
    - calculates the probability of “x” UXO per acre in the sector
  - Confidence module
    - calculates the UXO density based upon the specified probability
  - Variances module
    - calculates the upper and lower bound of the confidence interval based upon the specified probability

Sector Module



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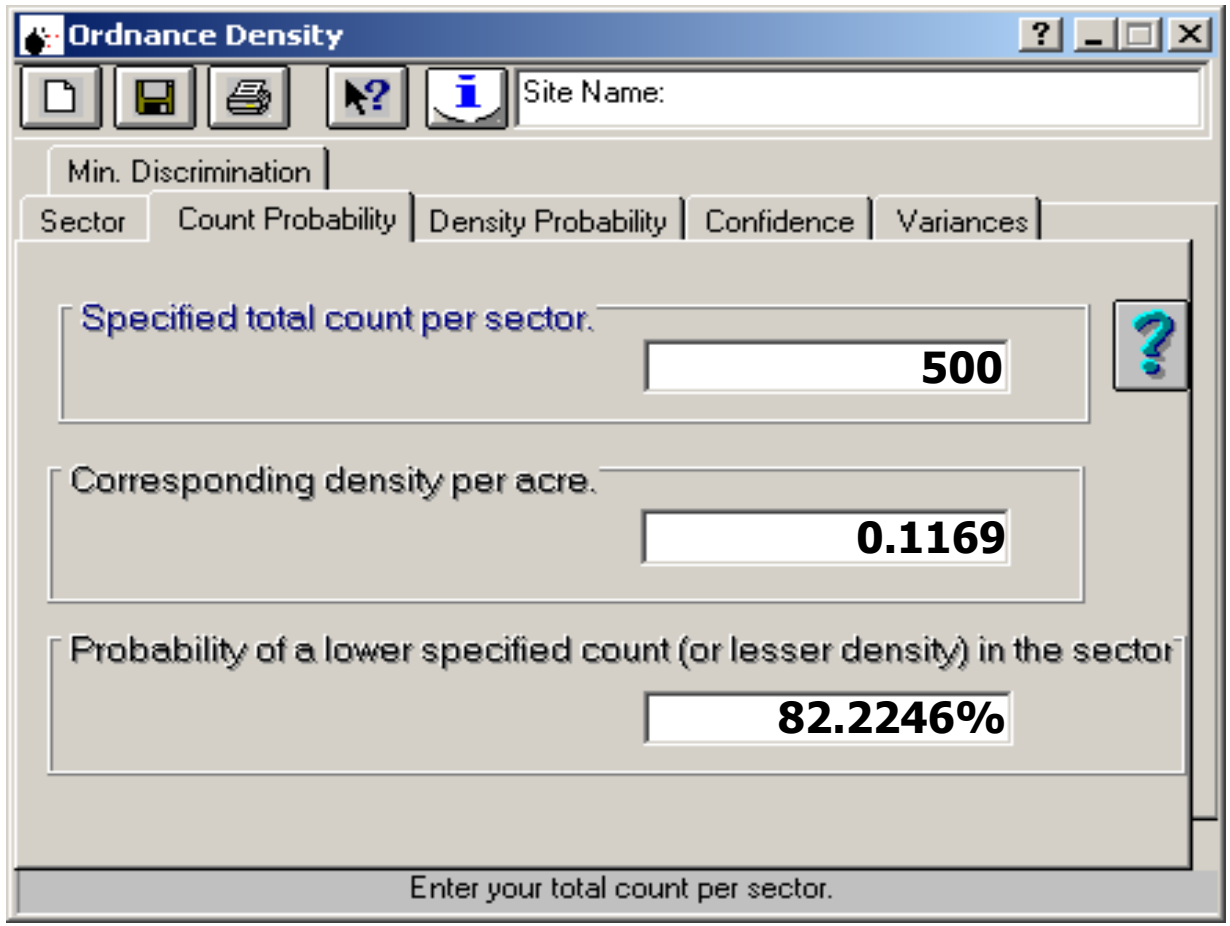
Count Probability Module



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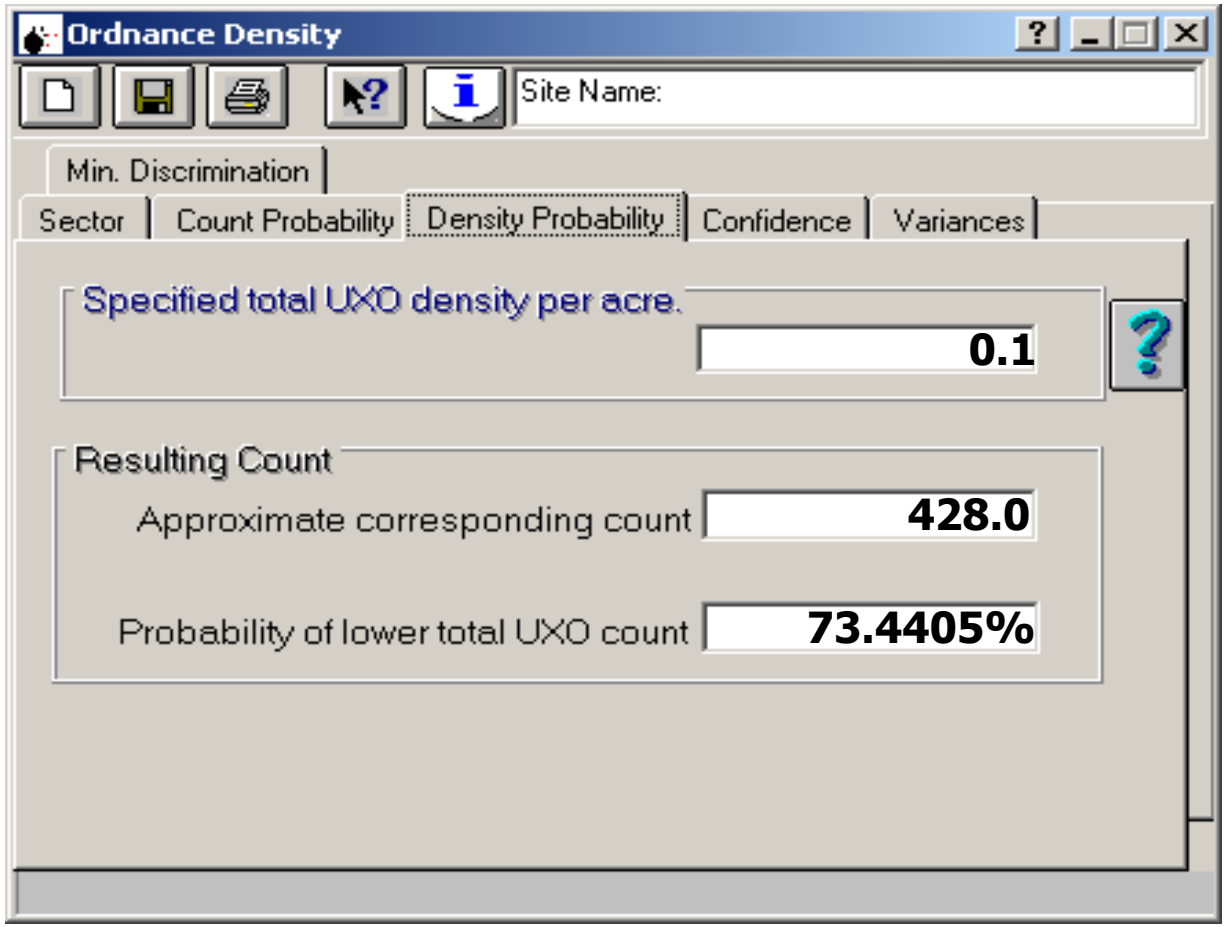
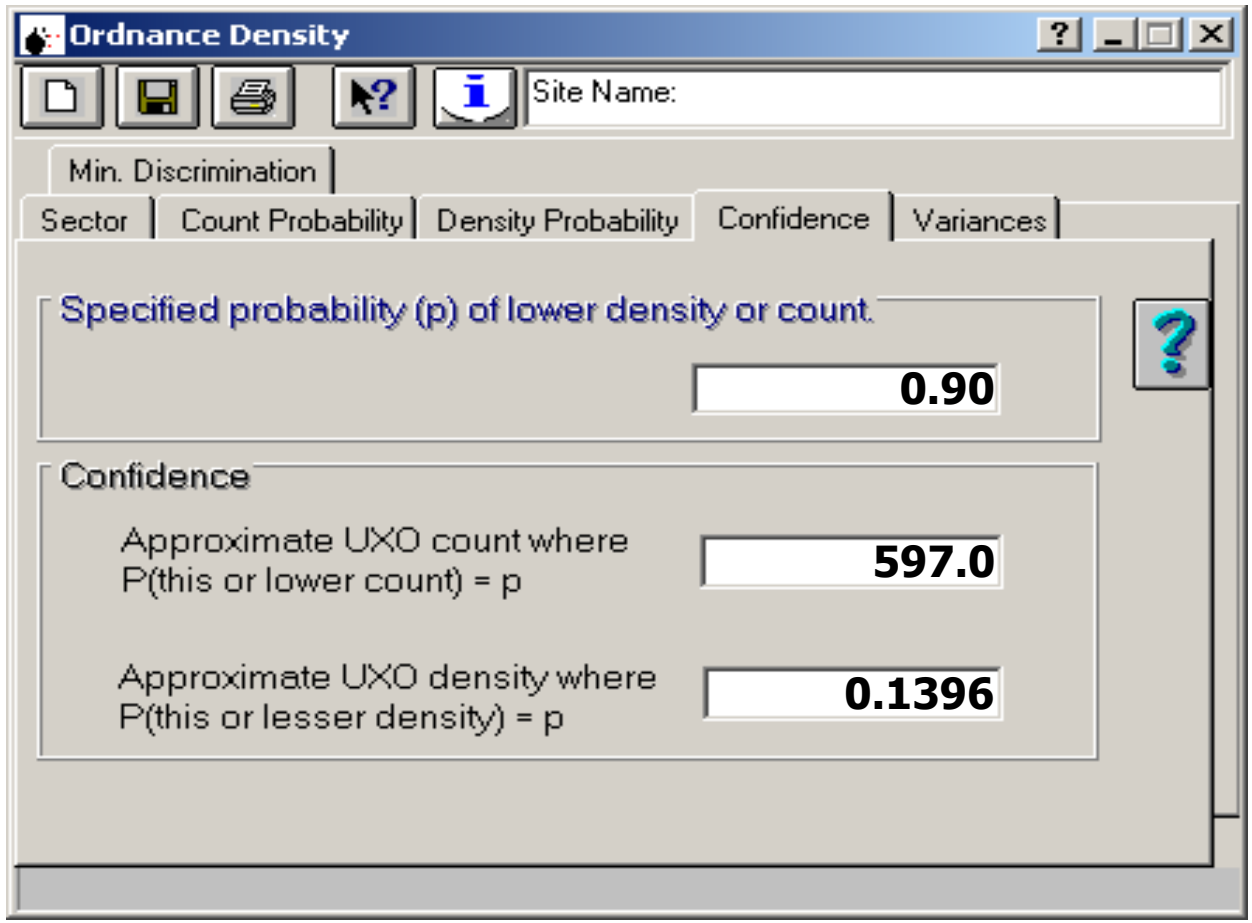
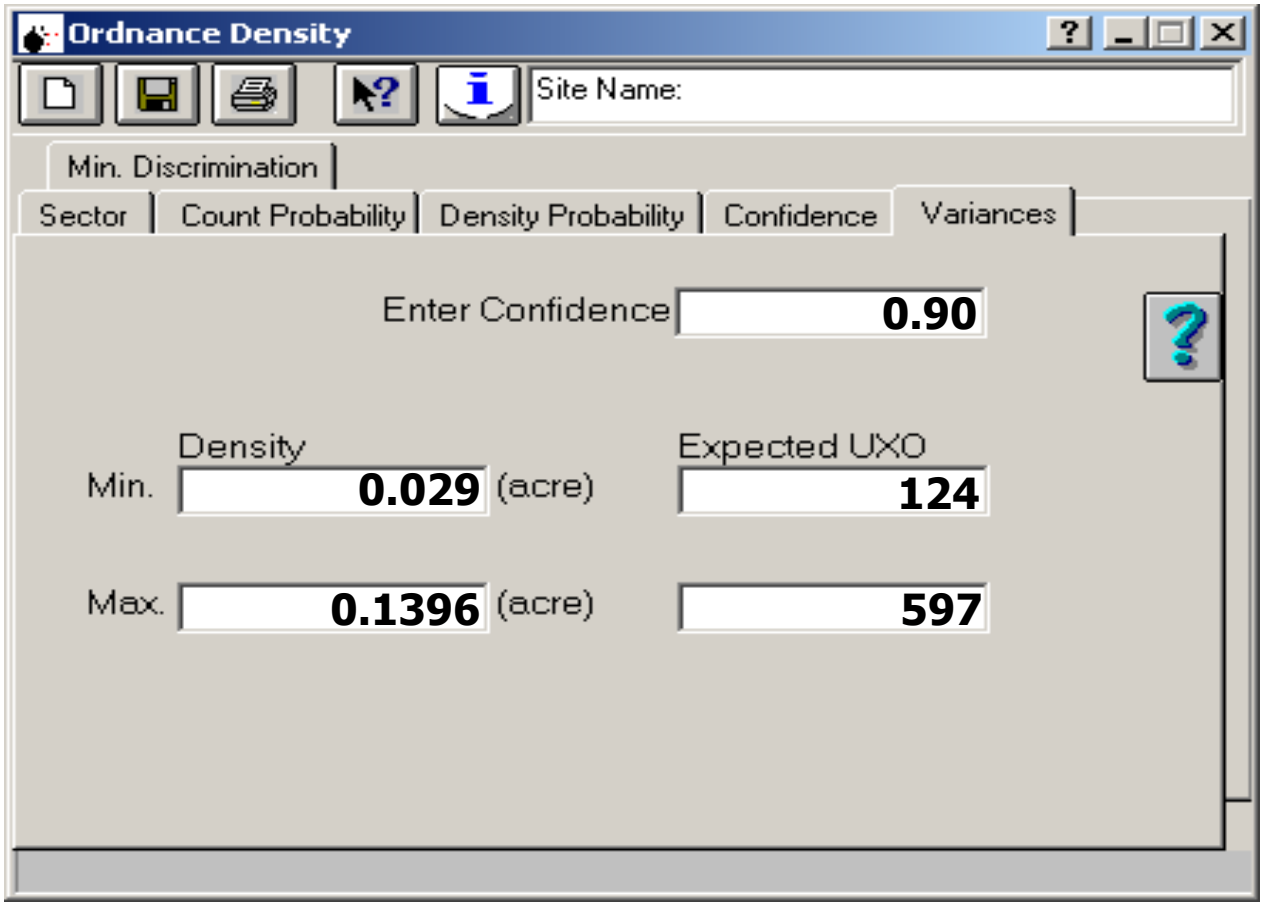
Density Probability Module



Confidence Module



Variances Module



Limitations

- Does not take into account the location of UXO found, only the amount of UXO found
- Homogeneity is assumed rather than proven
- Does not predict well for sites with OE burials
- Will not determine if a site is clean, just that there is a high confidence that the density is below a certain target value.

Conclusion

- UXO Calculator can be a good tool to assist in statistical surveying and UXO density analysis
- Make sure you have a project need for the predicted density before inclusion in an EE/CA
- Make sure that the you are communicating what you want to communicate